

‘Microbially induced sedimentary structures’ - a new group of biosignatures

Nora Noffke

Department of Ocean, Earth & Atmospheric Sciences

Old Dominion University

Norfolk, VA 26529

USA

nnoffke@odu.edu

The NASA strategy on the exploration of extraterrestrial environments calls for investigations of biosignatures such as isotope signatures, biomarker molecules, or sedimentary structures, that provide hints on existing or past life.

‘Microbially induced sedimentary structures (MISS)’ constitute a new category of biosignatures that can be investigated on Earth in order to provide data for the life detection on other planets. The structures are formed in siliciclastic marine environments by the interaction of photoautotrophic microbial mats with the prevailing physical sediment dynamics.

Investigations conducted in modern coastal zones show, how ‘biostabilization’, ‘baffling, trapping, and binding’ or ‘leveling’ of the microbial populations induce the formation of a great variety of MISS. Features such as ‘erosional remnants and pockets’, ‘biolaminites’, ‘wrinkle structures’ and many more cannot only be found in the Recent. Fossil examples have been documented in sedimentary rocks of all Earth ages.

The MISS in both modern and ancient environments show a distinct pattern of distribution, which is related to a specific sedimentary facies. This distribution reflects the dynamic conditions at the sites of bacterial colonization. Therefore, MISS are highly facies-indicative. In addition, the geometry and appearance of the various MISS permit conclusions on the composition of the microbial communities.

The Archean MISS are the complements to stromatolites and chert fossils, and open a new window for the understanding of ancient environments and the life within, on Earth and other planets.